

Meeting Vision Requirements of Future Combat Systems



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27 January 2004

The Issues

- How are visual demands changing?
- What aspects of visual performance are going to be key?
- What we've learned about vision in aviation.
- Should there be a new standard?

Changing visual demands

- Computer systems
- Displays



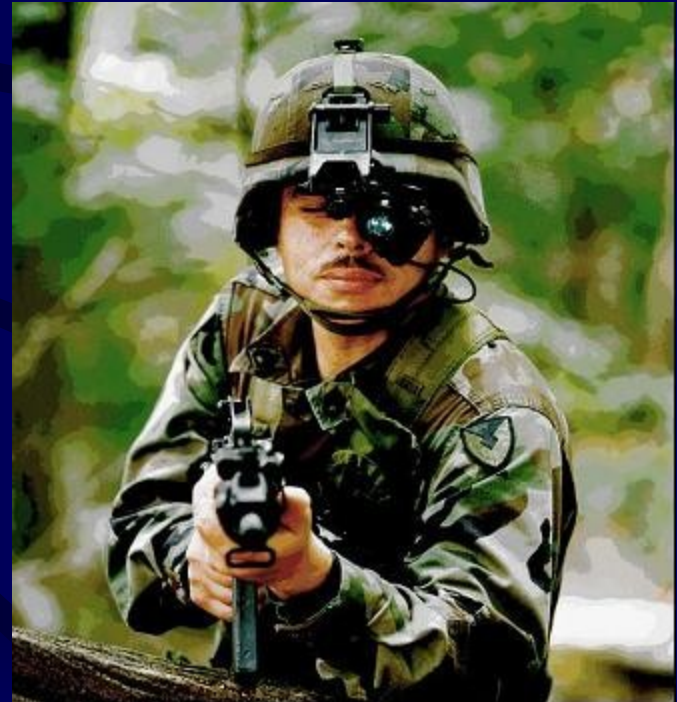
Changing visual demands

- Sighting Systems



Changing visual demands

- Night and Night Vision Goggles (NVGs)



Changing visual demands

- Night and Night Vision Goggles (NVGs)



Changing visual demands



- Augmented vision
- Virtual reality
- Remote vision



Using this display panel in the UH-60 Apache Longbow, Army pilots used their ability to fly the Director Unmanned Aerial Vehicle during the ongoing Joint Contingency Force Advanced Warfighting Experiment at Fort Belvoir, La.



Eli Pelli, Harvard
(Schepens Eye Research Institute)



Key aspects of vision

A B C

- Acuity
- Binocular Vision
- Color Vision
- (peripheral vision, visual field, motion detection, distance estimation, visual threshold, etc)

Current standards for acuity & how tested

- Aviation
 - 20/20 each eye (best corrected)
 - No worse than 20/50 each eye (uncorrected)
- Standard Service (best corrected)
 - 20/40 in one eye and 20/70 in the other - or
 - 20/30 in one eye and 20/100 in the other - or
 - 20/20 in one eye and 20/400 in the other

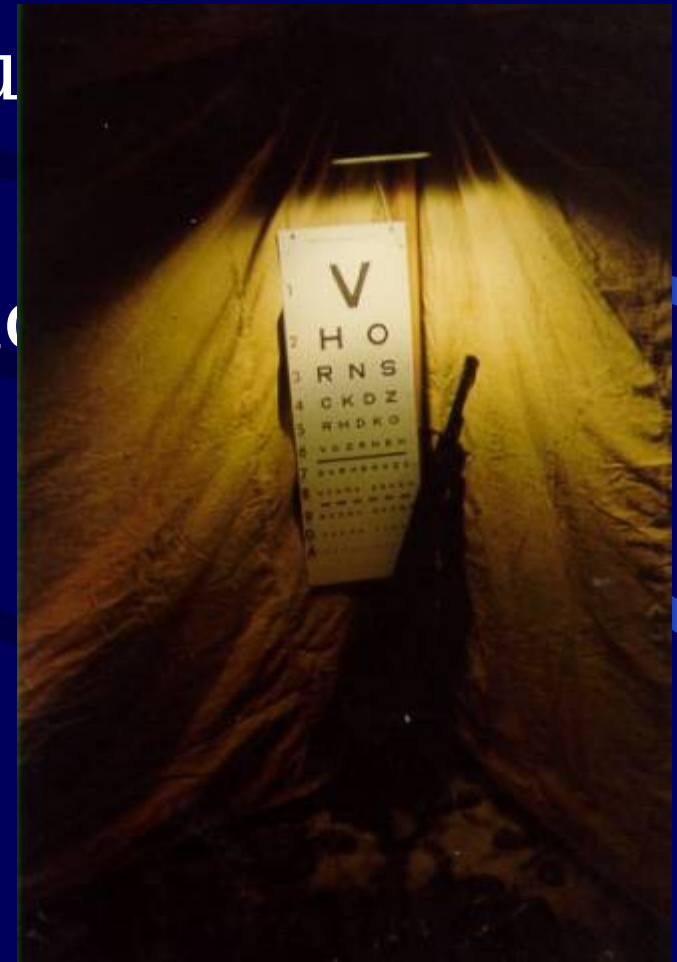
Much ado about acuity

- Individuals with “normal” acuity, but decreased contrast sensitivity are more affected under low contrast conditions (e.g. night or low luminance)
- In other words – Acuity = Vision

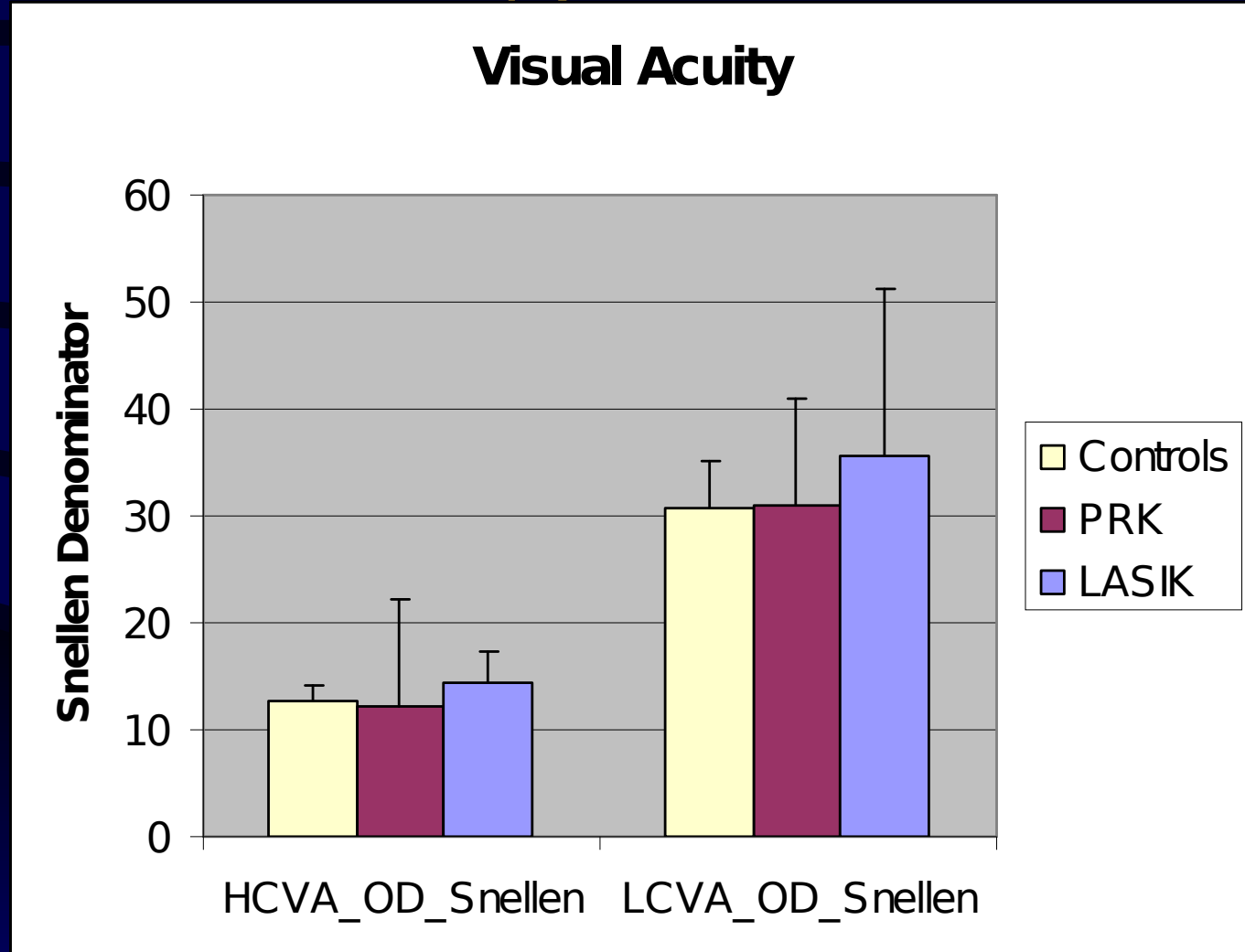


Research in acuity and contrast sensitivity

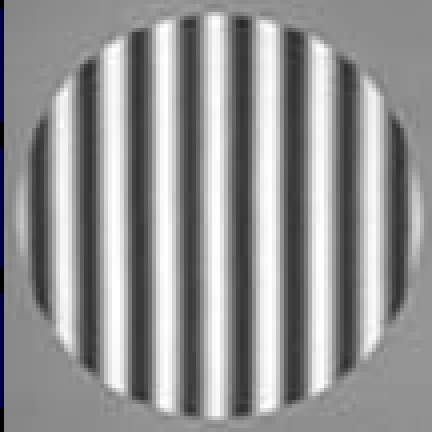
- Effects of refractive su
- Effects of defocus
- Effects of low luminanc



Acuity)

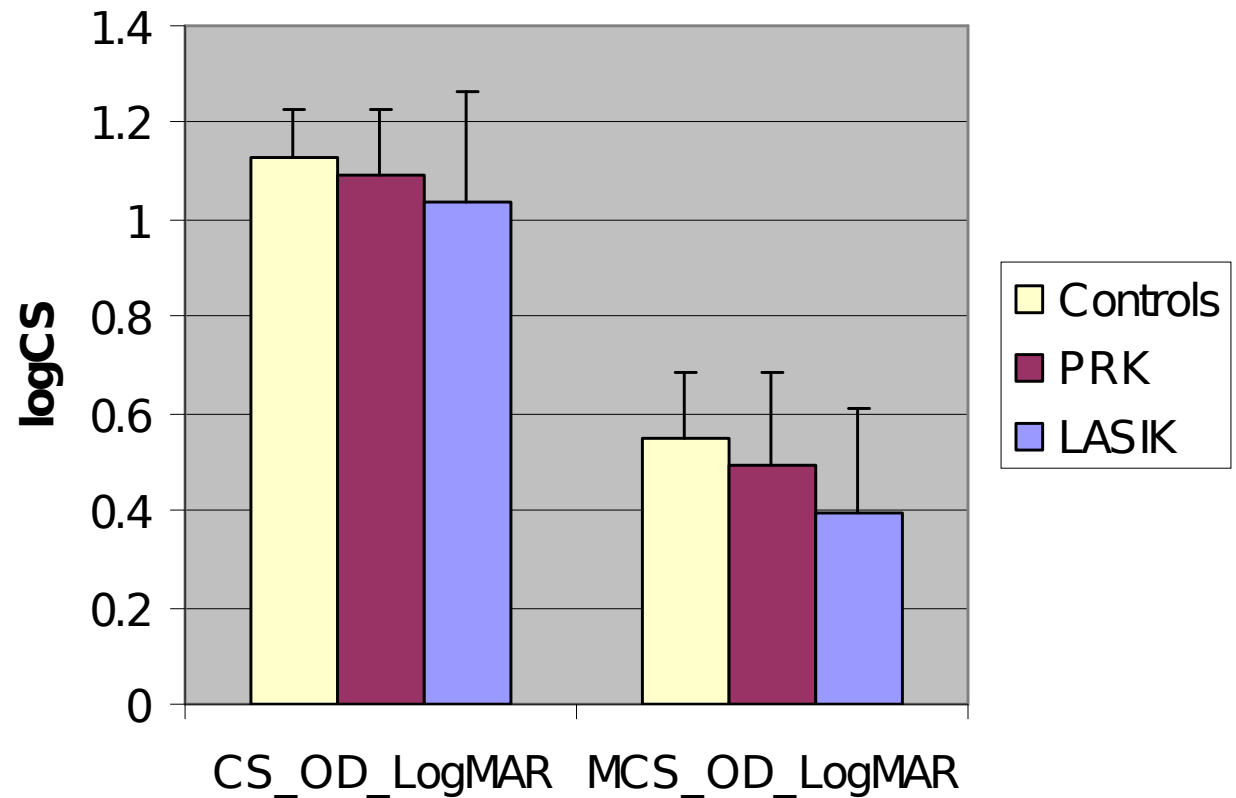


Visual Performance (Contrast Sensitivity)

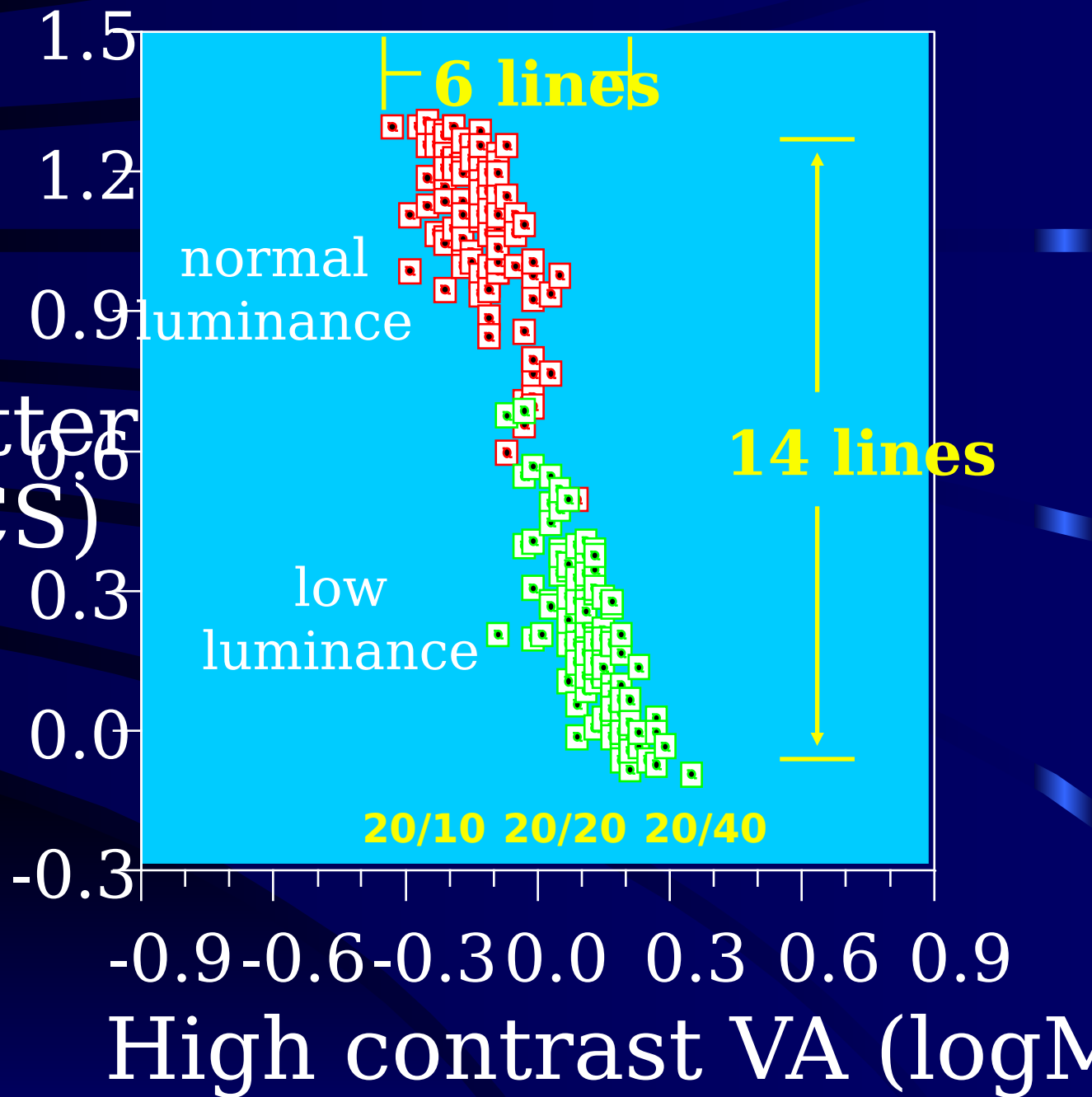


Row		LogCS
1	DREZUFVNHP	0.0
2	RPFDUNZEVH	0.1
3	HRPEDVZNFU	0.2
4	ZEDHPUVRNF	0.3
5	HPFDNVREVEH	0.4
6	RZFDPNUEVH	0.5
7	VDHPENRHZU	0.6
8	URNEDZHFPV	0.7
9	NVZFHEPRDU	0.8
10	DVNZRHFUPE	0.9
11	PHVDFUEZNR	1.0
12	RVUNDPHZE	1.1
13	FREUPZHDVR	1.2
14	ERPDNZFUVH	1.3

SLCT

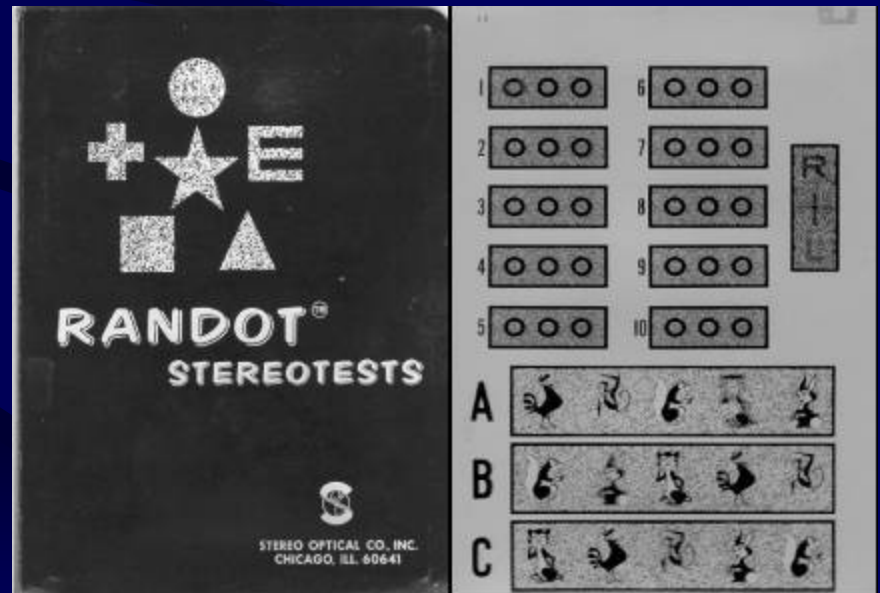


Small letter
CS (logCS)



Current standards for binocular vision (stereopsis) & how tested

- Aviation
 - 40 seconds of arc stereopsis
- Standard Service
 - None



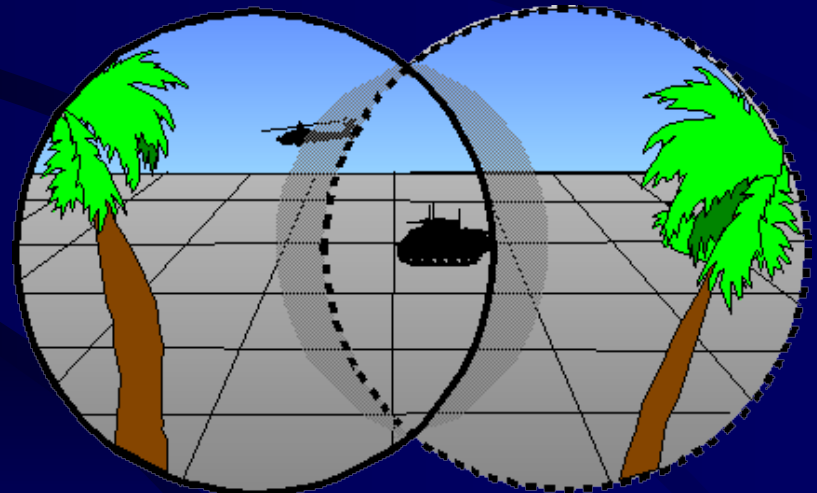
Much ado about stereopsis

- Stereopsis may become more important as binocular display systems (e.g. head-up displays) become the norm
- Suppression or diplopia (with poor



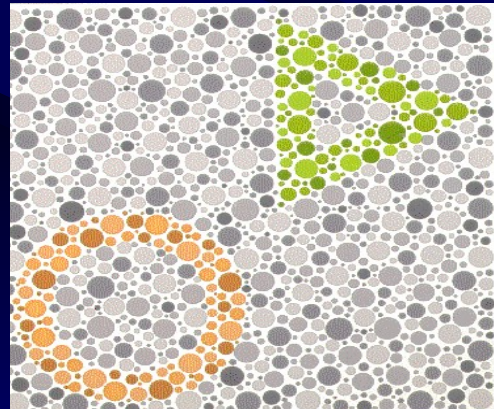
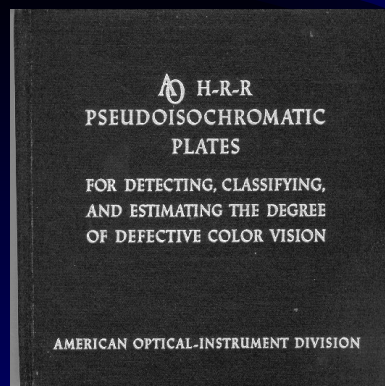
Research in depth perception & binocularity

- Use of monocular head-up display (Apache IHADSS)
- Binocular overlap
- Binocular tolerances in head-mounted



Current standards for color vision & how tested

- Aviation
 - 5 or more errors on PseudoIsochromatic Plates
 - FALANT testing
- Standard Service (best corrected)
 - Although there is no standard, adequate color vision is a prerequisite for entry into many military specialties.



Much ado about color vision

- As the information needed by the soldier becomes more complicated, color information will be used more often in displays.
- Current color vision tests cannot accurately assess subtle color differences.



Research in color vision

- Impact of color deficiency on performance (e.g. blue/yellow color defect)
- Impact of color filters on performance (e.g. blue blockers)
- Low contrast color vision performance (affected in early ocular disease – e.g. MS, glaucoma, macular dysfunction)



Should there be new standards?

- Current standards
- Fringe elements
- New technology



Current standards

- How well do the fringe elements perform?
- Failures in schooling?
- Self selection out of a career field?



Challenges of new technology

- Can limitations of the soldier be overcome by advances in technology? – or
- Will advances in technology be limited by the soldier?



Summary

- The visual demands for the future soldier are becoming more like the visual demands of the current aviator.
 - Acuity
 - Binocularity
 - Color vision
 - Other aspects to consider
- Lessons learned in aviation may enhance future selections across the services.
- Standards should be reviewed to determine operational applicability.

Questions?

